Two-dimensional organic materials offer atomic precision for optoelectronics and energy-efficient nanoelectronics, but most are not easily patterned and tuned. The fully conjugated Zn-porphene, (C$_{20}$N$_4$Zn)$_4$, has now been prepared from Zn porphyrin by oxidative polymerization on aqueous surface and transferred to solid substrates. Its structure was established by imaging as well as in-situ and ex-situ spectroscopy. Reversible insertion of other metal ions is possible and promises an atomic canvas for painting with thousands of distinct metal ions and ligands without taking any π centers out of conjugation. Unlike earlier computational results, which predicted a $P4mm$ ($D_{4h}$) square unit cell and metallic conductivity, ours resemble those for antiaromatic molecules and predict Zn-porphene to be a two-dimensional antiaromatic semiconductor with a pair of $P2mm$ ($D_{2h}$) rectangular unit cells, rapidly interconverting via a $P4mm$ ($D_{4h}$) square structure by tunneling and/or thermal excitation. This result is supported by measurements of electrical conductivity and of N(1s) chemical shift in X-ray photoelectron spectra.